

## SUMMARY OF CLAIMED SUBJECT MATTER

2 The invention presents a method and device that effectively  
combusts heavy hydrocarbon fuel oils by injecting them through a  
4 zone of combusting hydrogen where the oil is finely dispersed,  
partially vaporized and ignited. The zone of combusting  
6 hydrogen is formed by generating hydrogen and oxygen gas from an  
external electrolytic cell and piped to a plurality of nozzles  
8 on the burner's front face. The outlet ports of these nozzles  
point toward the axial center of the burner face. The hydrogen  
10 and oxygen gas flowing out of these ports is then ignited to  
produce relatively short flame jets having the tips meet along  
12 the axis of the burner. The burner head is then rotated at  
relatively high speed. Under rotation, the individual hydrogen  
14 gas flames form wrap together into a conical-shaped flame zone.  
The fuel oil can be mixed with water or steam and sprayed  
16 directly into the combusting hydrogen flame zone. The intense  
heat and turbulence inside the hydrogen flame zone serves to  
18 further disperse and vaporize the heavy fuel oil to promote the  
oil's combustion. The presence of water or steam also catalyzes  
20 a reforming reaction on contact with the hydrogen flame fronts.  
The hydrogen flame cone also continuously ignites the combusting  
22 oil, which forms a second fuel flame downstream of the hydrogen  
flame zone. The hydrogen flame zone remains stable while the

fuel/water/steam mixture is sprayed through it due the unique  
2 properties of hydrogen gas (i.e., fast flame speed).

4 INDEPENDENT CLAIM MAPPING

6 1.(currently amended) A method of combusting a liquid primary  
fuel comprising the steps of:

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establishing a first zone of combustion (p. 20, lines 4-5)  
10 formed by radially inwardly directed intersecting flames (p. 20,  
lines 4-6; FIG. 1) comprised essentially of burning hydrogen gas  
12 (p. 20, line 4) supplied from an external source (p. 24, lines  
1-2) and spaced from a fuel nozzle (FIG. 1),

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establishing a second zone of combustion comprising an atomized  
16 primary fuel that is ignited by contact with the first zone of  
combustion (p. 21, lines 1-6).

18 DEPENDENT CLAIM MAPPING

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2.(currently amended) The method of claim 1 wherein the first  
22 zone of combustion is established by the steps of:

providing a pressurized source of hydrogen through a conduit  
2 having a discharge opening adjacent to said first zone of  
combustion (p. 20, lines 4-5, FIG. 1),

4  
igniting the hydrogen exiting through said discharge opening to  
6 produce a hydrogen flame (p. 20, lines 4-5); and  
8 mechanically rotating the hydrogen flame about a longitudinal  
axis of the first zone of combustion (p. 20, lines 5-9).

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4.(currently amended) The method of claim 2 where the hydrogen  
12 flowing through the conduit includes at least a stoichiometric  
amount of oxygen to sustain combustion of the hydrogen (p. 24,  
14 lines 3-5).

16 6.(previously presented) The method of claim 2 wherein a speed  
of the rotating hydrogen flame in a circumferential direction is  
18 not less than the forward flame velocity of the ignited hydrogen  
(p. 23, lines 6-10).

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7.(previously presented) The method of claim 1 wherein said step  
22 of dispersing said liquid primary fuel further comprises flowing  
a pressurized source of liquid primary fuel through a conduit of  
24 a rotating shaft and including a discharge end having an

atomizing nozzle to discharge the liquid primary fuel into the  
zone of combustion. (p. 21, lines 1-2; FIG. 1; p. 29, lines 7-8;  
p. 30, lines 7-8; FIG. 2; p. 38, line 4)

8. (canceled)

9. (previously presented) The method of claim 1 where said  
primary fuel is selected from the group comprising processed and  
unprocessed vegetable oils, by-product oils from agricultural  
products processing, liquid and liquefied petroleum fuels, and  
liquid and liquefied animal fats. (p. 1, line 1; p. 9, line 11;  
p. 10)

10. (currently amended) The method of claim 2 where the step of  
providing pressurized hydrogen from the hydrogen source further  
includes the steps of:

generating a constant rate of hydrogen and oxygen gases from the  
electrolysis of water (p. 24, line 3), and

transferring the hydrogen and oxygen gases into a fixed-volume  
staging chamber such that the hydrogen and oxygen gases are  
continuously exposed to an inlet opening of the conduit (p. 30,  
lines 1-2).

11. (currently amended) The method of claim 1 further including  
a step of injecting a controlled rate of an additive selected  
from steam or water into the first zone of combustion (p. 33,  
line 19).

12.(currently amended) The method of claim 11 wherein the  
injection of said additive is accomplished by pre-mixing the  
additive at a controlled rate with the liquid primary fuel (p.  
33. line 19).

24.(currently amended) The method of claim 2 further comprising  
the steps of providing a second conduit (p. 23, line 4; FIG. 1)  
for delivering hydrogen through a second discharge opening  
adjacent to the first zone of combustion, igniting the hydrogen  
discharging through said second discharge opening to produce a  
second hydrogen flame, and rotating said second hydrogen flame  
about the longitudinal axis (p. 20, line 4-7).

25.(previously presented) The method of claim 24 further  
comprising the steps of providing a plurality of additional  
conduits for delivering hydrogen through additional discharge  
openings with said additional discharge openings extending  
radially outward from the longitudinal axis relative to the

first two hydrogen discharge openings, igniting the hydrogen  
2 discharging through said additional conduits to produce a  
plurality of hydrogen flames, and rotating said plurality of  
4 hydrogen flames about the longitudinal axis in the same  
rotational direction as said first and second discharge openings  
6 (p. 23, line 4).

8 26.(previously presented) The method of claim 25 where the  
plurality of additional conduits for delivering hydrogen are  
10 rotated in a direction opposite to the first and second conduits  
along the longitudinal axis (p. 25, lines 10-12).

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